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PRODUCTION OF EXPLOSIVES IN THE UNITED STATES

DURING THE CALENDAR YEAR 1917

WITH NOTES ON COAL-MINE ACCIDENTS DUE TO EXPLOSIVES
AND LIST OF PERMISSIBLE EXPLOSIVES
TESTED PRIOR TO APRIL 30, 1918

COMPILED BY

ALBERT H. FAY

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PRODUCTION AND DISTRIBUTION OF EXPLOSIVES IN THE UNITED STATES DURING THE CALENDAR YEAR 1917.

Compiled by ALBERT H. FAY.

INTRODUCTION.

The total production, excluding exports, of explosives in the United States during the calendar year 1917, according to figures that the Bureau of Mines has received from manufacturers, was 582,475,327 pounds (291,238 short tons), as compared with 505,415,052 pounds (252,708 short tons) in 1916.

The production for 1917 is segregated as follows: Black powder, 277,118,525 pounds; "high" explosives other than permissible explosives, 262,316,080 pounds; and permissible explosives 43,040,722 pounds. These figures represent an increase of 61,543,500 pounds of black powder, 7,161,293 pounds of high explosives, and 8,355,482 pounds of permissible explosives, as compared with figures for 1916.

As explosives are essential to mining and the use of improved types of explosives tends to lessen the hazards of this industry, the Bureau of Mines has undertaken the compilation of annual reports showing the total amount of explosives manufactured and used in the United States. Its first report, Technical Paper 69, deals with the year 1912; this report for 1917 is, therefore, the sixth of the series.

CLASSIFICATION OF EXPLOSIVES.

The production figures tabulated herein are classified as follows:

1. *Black blasting powder.*—All black powder with sodium or potassium nitrate as a constituent is here classified as black blasting powder.

2. *High explosives.*—Dynamite and all other high explosives of various trade names and compositions, except permissible explosives, are put in this class.

3. *Permissible explosives.*—In this class are included ammonium nitrate explosives, hydrated explosives, organic nitrate explosives, and certain nitroglycerin explosives containing an excess of free water or carbon. All permissible explosives have passed certain tests of the Bureau of Mines and are not to be regarded as permissible unless used in the manner specified by the bureau.[a]

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[a] Hall, Clarence, Snelling, W. O., and Howell, S. P., Investigations of explosives used in coal mines, with a chapter on the natural gas used at Pittsburgh, by G. A. Burrell, and an introduction by C. E. Munroe: Bull. 15, Bureau of Mines, 1912, 197 pp.

Hall, Clarence, and Howell, S. P., Tests of permissible explosives: Bull. 66, Bureau of Mines, 1913, 313 pp.

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The Bureau of Mines takes this opportunity to express its appreciation of the aid rendered by the manufacturers in furnishing the data compiled and to Mr. C. Stewart Comeaux, secretary of the Institute of the Makers of Explosives. The author acknowledges the assistance rendered by W. W. Adams and Miss L. S. Gerry in compiling the various tables.

SCOPE OF STATISTICS.

Table 1 gives the quantity of explosives used in each State during the calendar years 1916 and 1917. Tables 2, 3, and 4 present the total production and uses, by groups of States, of black powder, high explosives, and permissible explosives, the States being grouped so as to include regions where the general conditions of mining are roughly similar.

Table 5 shows the rapid increase in the production and sale of permissible explosives for use in coal mines. In 1902 only 11,300 pounds of short-flame or "safety" explosives were used in coal mining, whereas in 1917 the quantity of permissible explosives so used was 32,910,397.

The quantity of permissible explosives used in the United States is larger than that of the corresponding explosives used in a number of foreign countries. In 1912 it represented about 5 per cent of the total quantity of explosives produced, and in 1917, 7.4 per cent. The total amount of explosives used for the production of coal in 1917 was 296,923,504 pounds, of which over 11 per cent was of the permissible class.

Table 6 gives the quantities of permissible explosives used for coal mining in the various coal fields. Table 10 shows that in 1917 about 77 per cent of the permissible explosives manufactured were used for coal mining. The remaining 23 per cent was reported under the items "other mining" and "all other purposes," as indicated in Tables 4 and 10.

The figures for 1917 represent the reports of 28 manufacturers who operated their various plants during the year. Many of the manufacturers operated more than one plant, so that their number does not necessarily indicate the total number of plants. The number of manufacturers reporting sales of black powder was 22, of high explosives 20, and of permissible explosives 11. A number of other companies reported their plants as idle during the year, or as having been sold to other manufacturers.

The reports of manufacturers of fireworks and of ammunition are not included, inasmuch as the majority of these manufacturers

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purchase their explosives from one or more of the manufacturers of explosives whose production has been included in the tabulations presented herein.

PRODUCTION AND DISTRIBUTION OF EXPLOSIVES.

The production and use of explosives in the United States are given in detail in Tables 1 to 6 following.

TABLE 1.—*Amount of explosives (excluding exports) manufactured in the United States and used in the various States during the calendar years 1916 and 1917.*

State.	1916			1917		
	Black blasting powder.	High explosives other than permissible.	Permissible explosives.	Black blasting powder.	High explosives other than permissible.	Permissible explosives.
	Kegs.	*Pounds.*	*Pounds.*	*Kegs.*	*Pounds.*	*Pounds.*
Alabama	194,554	5,412,151	3,547,481	260,017	6,319,574	4,322,120
Alaska	52,156	5,761,280	69,200	86,222	5,083,485	63,700
Arizona	24,194	13,002,555	20,000	31,510	14,992,697	130,300
Arkansas	108,928	1,537,717	116,800	140,081	1,400,070	69,300
California	79,067	13,942,055	10,650	124,048	13,617,199	20,450
Colorado	78,572	8,826,030	788,344	113,583	7,700,225	994,005
Connecticut	1,915	756,000	1,000	752	632,425	750
Delaware	257	41,120	100	186	54,750	....
Florida	2,190	1,548,975	6,000	1,714	1,717,350	760
Georgia	40,655	1,008,825	3,460	41,184	1,002,789	404,540
Idaho	4,980	5,133,090	....	4,471	5,362,200	....
Illinois	1,324,802	5,984,889	1,906,280	2,020,412	5,644,191	2,379,350
Indiana	579,080	2,234,801	177,350	1,021,329	2,161,119	242,525
Iowa	322,004	1,840,906	4,950	444,276	1,996,682	2,700
Kansas	511,431	3,334,298	19,425	550,705	4,551,628	221,556
Kentucky	299,072	1,680,448	861,815	545,401	2,169,169	1,042,190
Louisiana	171	1,143,442	21,700	9	1,200,658	62,000
Maine	3,033	501,500	....	2,313	531,425	....
Maryland [a]	30,813	[a] 1,434,399	18,650	47,043	1,565,975	50,075
Massachusetts	4,734	578,645	2,000	2,977	594,115	13,450
Michigan	23,856	29,691,122	143,058	34,894	29,099,611	155,100
Minnesota	146,211	10,220,182	....	173,926	11,694,029	....
Mississippi	2,345	394,166	80	2,260	438,825	500
Missouri	182,255	24,875,757	44,039	227,080	20,939,965	240,470
Montana	100,975	9,162,385	39,200	138,759	7,774,421	51,050
Nebraska	4,130	227,480	1,341	5,002	162,240	1,997
Nevada	7,728	7,378,443	182,500	6,450	7,693,795	....
New Hampshire	801	103,750	2,500	323	112,900	500
New Jersey	2,525	2,448,034	2,175	2,181	2,434,467	950
New Mexico	33,423	3,061,951	615,925	30,729	3,741,454	730,375
New York	22,341	8,276,568	1,041,155	21,658	8,013,247	1,119,225
North Carolina	20,812	2,070,258	200	23,922	1,816,720	1,050
North Dakota	19,818	316,850	50	32,831	345,480	100
Ohio	426,300	7,089,041	48,701	638,519	7,108,617	82,744
Oklahoma	171,439	4,163,922	388,000	200,609	9,044,506	566,791
Oregon	15,733	2,578,689	2,000	18,171	3,089,516	1,550
Pennsylvania	2,407,226	31,935,073	13,832,192	2,504,344	35,831,445	17,521,706
Rhode Island	178	50,775	....	283	65,275	....
South Carolina	15,486	673,050	1,500	7,541	491,000	2,640
South Dakota	2,732	2,272,840	....	2,699	1,736,930	....
Tennessee	167,997	4,019,491	230,116	183,151	3,336,285	252,002
Texas	61,948	2,090,640	2,300	69,361	1,766,550	69,100
Utah	44,253	5,408,037	5,142,100	30,135	4,661,250	4,652,950
Vermont	9,769	209,700	400	7,485	338,250	2,000
Virginia	129,164	3,568,615	373,480	148,467	3,289,350	425,775
Washington	48,625	6,546,844	203,700	39,108	6,031,522	388,100
West Virginia	776,713	3,487,171	4,476,595	932,282	4,795,859	6,256,176
Wisconsin	6,630	6,515,032	1,928	5,073	7,256,455	....
Wyoming	108,980	615,795	334,800	159,265	908,390	498,100
Total	[b] 8,623,001 [c] 215,575,025	255,154,787	34,685,240	[b] 11,084,741 [c] 277,118,525	262,316,080	43,040,722 ....
Grand total (pounds)		**505,415,052**			**582,475,327**	

[a] Includes District of Columbia.

[b] Kegs of 25 pounds each.

[c] Pounds.

TABLE 2.—*Amount of* **black blasting powder** *used in the United States during 1916 and 1917, classified by use.*

[Kegs of 25 pounds each.]

Groups of States.	Black blasting powder, 1916.				Black blasting powder, 1917.			
	Coal mining.	Other mining.	Railway and other construction work.	All other purposes.	Coal mining.	Other mining.	Railway and other construction work.	All other purposes.
	Kegs.	*Kegs.*	*Kegs.*	*Kegs.*	*Kegs.*	*Kegs.*	*Kegs.*	*Kegs.*
Group 1. Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont		537	170	17,808		429	5	12,947
Group 2. Connecticut, New Jersey, and New York		6,153	1,484	19,144		4,828	1,320	18,443
Group 3. Delaware, District of Columbia, Maryland, and Virginia	119,674	3,655	20,523	16,382	175,829	1,820	7,903	10,144
Pennsylvania	2,012,641	6,652	76,080	311,853	2,193,020	8,160	52,845	250,319
West Virginia	718,220	5,220	20,211	33,062	867,673	4,852	32,334	27,423
Group 4. Florida, Georgia, North Carolina, and South Carolina	9,172	6,786	49,554	13,631	7,595	6,698	46,803	13,265
Group 5. Indiana and Kentucky	803,216	10,892	11,471	52,573	1,451,976	12,071	17,651	85,032
Illinois	1,287,570	2,433	243	34,556	1,964,578	8,011	1,618	46,205
Ohio	364,760	28,122	7,638	25,780	565,950	26,599	8,987	36,983
Group 6. Alabama, Mississippi, and Tennessee	286,809	20,936	28,548	28,603	372,425	19,508	27,831	25,664
Group 7. Michigan, Minnesota, and Wisconsin	13,290	147,738	4,544	11,125	23,904	181,742	1,712	6,535
Group 8. Iowa, Kansas, Missouri, and Nebraska	932,095	5,389	11,967	70,369	1,120,206	22,142	20,606	64,109
Group 9. Arkansas, Louisiana, Oklahoma, and Texas	287,799	12,136	9,578	32,973	358,105	8,253	17,807	25,895
Group 10. Montana, North Dakota, South Dakota, and Wyoming	146,427	12,080	27,774	46,224	209,576	23,221	51,967	48,790
Group 11. Colorado, New Mexico, and Utah	72,951	27,052	32,458	23,787	94,968	20,549	15,295	43,635
Group 12. Alaska, Idaho, Oregon, and Washington	24,417	2,665	63,070	31,342	24,027	680	104,521	18,744
Group 13. Arizona, California, and Nevada		15,405	63,540	32,044	180	28,636	107,687	25,505
Total (kegs)	7,079,041	313,851	428,853	801,256	9,430,012	378,199	516,892	759,638
Grand total (kegs)	**8,623,001**				**11,084,741**			

TABLE 3.—*Amount of high explosives used in the United States during 1916 and 1917, classified by use.*

Groups of States.	High explosives other than permissible explosives, 1916.				High explosives other than permissible explosives, 1917.			
	Coal mining.	Other mining.	Railway and other construction work.	All other purposes.	Coal mining.	Other mining.	Railway and other construction work.	All other purposes.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Group 1. Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont	....	41,100	321,445	1,081,825	....	101,650	253,699	1,286,616
Group 2. Connecticut, New Jersey, and New York	....	3,603,670	2,188,544	5,688,388	....	4,633,300	1,621,411	4,825,428
Group 3. Delaware, District of Columbia, Maryland, and Virginia	331,625	797,800	951,715	2,962,994	649,250	670,500	709,025	2,881,300
Pennsylvania	16,020,988	1,250,576	1,651,332	13,012,177	18,406,464	646,346	2,030,572	14,748,063
West Virginia	570,625	205,250	656,975	2,054,321	1,162,277	63,825	1,030,899	2,538,858
Group 4. Florida, Georgia, North Carolina, and South Carolina	5,050	625,530	1,851,885	2,818,643	147,400	706,735	1,595,970	2,577,754
Group 5. Indiana and Kentucky	185,686	50,750	566,175	3,112,638	707,591	182,425	880,828	2,559,444
Illinois	148,826	1,046,675	922,500	3,866,888	533,075	1,303,650	407,584	3,399,882
Ohio	96,330	393,715	504,207	6,094,789	448,681	342,300	347,073	5,970,563
Group 6. Alabama, Mississippi, and Tennessee	619,820	5,901,200	1,238,739	2,066,049	1,039,959	5,784,475	1,157,935	2,112,315
Group 7. Michigan, Minnesota, and Wisconsin	48,450	39,302,415	689,519	6,385,952	85,375	39,647,146	662,097	7,655,477
Group 8. Iowa, Kansas, Missouri, and Nebraska	1,329,800	22,259,511	1,018,873	5,670,257	2,761,275	19,927,340	885,900	4,076,000
Group 9. Arkansas, Louisiana, Oklahoma, and Texas	225,500	3,126,300	952,944	4,630,977	424,015	7,979,394	893,757	4,114,618
Group 10. Montana, North Dakota, South Dakota, and Wyoming	450,150	9,964,605	740,615	1,212,500	752,975	8,032,678	630,410	1,349,158
Group 11. Colorado, New Mexico, and Utah	402,345	9,093,161	689,980	7,110,532	401,520	9,343,629	228,585	6,129,195
Group 12. Alaska, Idaho, Oregon, and Washington	464,210	8,563,685	3,573,626	7,418,382	742,950	7,149,095	3,566,770	8,107,908
Group 13. Arizona, California, and Nevada	2,000	25,527,705	3,386,302	5,407,046	....	25,721,027	3,515,712	7,066,952
Total (pounds)	20,901,405	131,753,648	21,905,376	80,594,358	28,262,807	132,235,515	20,418,227	81,399,531
Grand total (pounds)	**255,154,787**				**262,316,080**			

TABLE 4.—*Amount of* **permissible explosives** *used in the* ***United States during 1916 and 1917, classified by use.***

Groups of States.	Permissible explosives, 1916.				Permissible explosives, 1917.			
	Coal mining.	Other mining.	Railway and other construction work.	All other purposes.	Coal mining.	Other mining.	Railway and other construction work.	All other purposes.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Group 1. Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont		300		4,600		500		15,450
Group 2. Connecticut, New Jersey, and New York		983,700	400	60,230		1,107,825	2,000	11,100
Group 3. Delaware, District of Columbia, Maryland, and Virginia	288,230	32,050	2,150	69,800	380,825	19,250		75,775
Pennsylvania	13,016,638	7,850	21,600	786,104	15,517,675	2,500	27,250	1,974,281
West Virginia	4,055,445	3,000	5,650	412,500	5,899,019	7,500	8,100	341,557
Group 4. Florida, Georgia, North Carolina, and South Carolina		2,390	1,000	7,770	50	800		408,140
Group 5. Indiana and Kentucky	955,015	21,450	2,850	59,850	1,181,115	7,400	1,000	95,200
Illinois	1,826,375	7,350		72,555	2,213,500	90,500	5,400	69,950
Ohio	5,926	27,250		15,525	6,948	4,500	2,000	69,296
Group 6. Alabama, Mississippi, and Tennessee	3,554,892	122,210	18,700	81,875	4,296,640	173,200	9,260	95,522
Group 7. Michigan, Minnesota, and Wisconsin	400	130,183		14,403	50	137,400		17,650
Group 8. Iowa, Kansas, Missouri, and Nebraska	18,525	7,975		43,255	13,590	65,600	6,225	381,308
Group 9. Arkansas, Louisiana, Oklahoma, and Texas	403,900	9,050	10,400	105,450	610,455	61,950	3,400	91,386
Group 10. Montana, North Dakota, South Dakota, and Wyoming	335,600	38,000		450	478,000	28,100	500	42,650
Group 11. Colorado, New Mexico, and Utah	1,908,675	4,532,100	32,350	73,244	1,945,180	4,188,650	21,050	222,450
Group 12. Alaska, Idaho, Oregon, and Washington	196,200	69,550	2,000	7,150	366,200	61,750	20,000	5,400
Group 13. Arizona, California, and Nevada	700	212,150		300	1,150	144,800		4,800
Total (pounds)	26,566,521	6,206,558	97,100	1,815,061	32,910,397	6,102,225	106,185	3,921,915
Grand total (pounds)	**34,685,240**				**43,040,722**			

TABLE 5.—*Yearly sales of short-flame explosives used in coal mines in the United States, 1901–1917.*

Year.	Quantity sold.	Year.	Quantity sold.
	Pounds.		*Pounds.*
1901	....	1910	11,820,836
1902	11,300	1911	13,428,239
1903	288,661	1912	18,150,618
1904	608,270	1913	21,804,285
1905	1,031,300	1914	19,593,892
1906	1,533,575	1915	21,841,659
1907	2,095,244	1916	26,566,521
1908	2,108,610	1917	32,910,397
1909	8,942,857		

TABLE 6.—*Quantity of permissible explosives used in different coal fields in the United States, 1912–1917.*

Coal fields and regions.	1912	1913	1914	1915	1916	1917
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
1. Pennsylvania anthracite field	2,177,172	3,294,225	4,380,635	5,037,050	5,219,032	7,298,925
2. Northern Appalachian region[a]	9,190,025	9,744,810	7,966,464	9,435,318	12,147,207	14,505,542
3. Southern Appalachian region	3,995,485	4,481,975	3,510,013	3,447,964	4,386,757	5,287,755
4. Eastern interior field	751,005	2,058,075	1,364,450	1,631,775	1,949,925	2,403,600
5. Western interior field	440,825	377,625	411,937	433,010	422,425	624,045
6. Rocky Mountain region	1,473,129	1,634,575	1,796,750	1,710,992	2,244,275	2,423,180
7. Pacific coast region	122,977	213,000	163,643	145,550	196,900	367,350
Total	18,150,618	21,804,285	19,593,892	21,841,659	26,566,521	32,910,397

[a] Not including Pennsylvania anthracite field.

TABLE 7.—*Coal-mine fatalities due to explosives, 1911–1917.*

States.	1911	1912	1913	1914	1915	1916	1917
Pennsylvania	94	85	79	97	88	96	62
West Virginia	3	8	8	5	6	3	6
Illinois	15	11	11	9	11	6	9
Ohio	3	5	6	2	3	5	4
Indiana, Michigan, and Kentucky	15	3	5	12	12	10	14
Alabama, Tennessee, Georgia, and North Carolina	6	6	2	2	10	3	3
Iowa, Kansas, and Missouri	4	14	6	4	13	9	2
Colorado, New Mexico, and Utah	3	1	7	4	....	4	3
Maryland and Virginia	....	10	2	....	4	3	2
Montana, North Dakota, and Wyoming	4	2	4	4	3	2	2
Arkansas, Oklahoma, and Texas	11	1	5	4	5	1	4
Alaska, California, Idaho, Nevada, Oregon, and Washington	2	1	3	3	....	4	....
Total, underground	160	147	138	146	155	146	111

FATALITIES IN THE MINING INDUSTRY DUE TO EXPLOSIVES.

Tables 7, 8, and 9 present the number of fatalities from the use of explosives in the mining industry. Table 7 gives all of the explosives fatalities at coal mines, and Table 8 those at bituminous mines alone. The latter table shows a decrease in the number of fatalities, as well as in the percentage and fatality rates. Inasmuch as 80 per cent of the permissible explosives used in coal mines are used in bituminous coal mines, it is interesting to compare Tables 8 and 5, for the former gives the decreased fatality rate, the latter the increased amount of permissible explosives used in and about coal mines. In 1903, 9.8 per cent of the fatalities at bituminous mines were due to the use of explosives, whereas in 1917 only 2.08 per cent were due to this cause.

Table 9 shows that from 11 to 14 per cent of the metal-mine fatalities and 16 to 26 per cent of the quarry fatalities are due to explosives.

DISTRIBUTION OF EXPLOSIVES BY PRINCIPAL INDUSTRIES.

Table 11 shows the percentage of black powder, high explosives, and permissibles used in the various branches of the mining industry. For example, in 1917, 85.1 per cent of the black powder was used in mining coal and only 3.4 per cent for other mining. In 1917 the mining industry of the United States used 76.4 per cent of the explosives produced, as compared with 73.2 per cent in 1916. Of the permissibles, 76.5 per cent in 1917 were used in coal mining and 14.2 per cent for other mining. Of high explosives only a small percentage is used for mining coal, and approximately 50 per cent is used for other mining.

TABLE 8.—*Fatalities due to explosives at* **bituminous** *coal mines, 1903–1917.*

Year.	Number killed.	Percentage of total killed.	Number killed per 1,000 employed.
1903	138	9.80	0.339
1904	121	8.64	.290
1905	119	7.49	.264
1906	115	7.27	.246
1907	134	5.29	.264
1908	109	6.17	.216
1909	122	5.88	.244
1910	113	5.09	.203
1911	72	3.68	.130
1912	70	3.85	.128
1913	63	2.91	.110
1914	56	3.01	.096
1915	76	3.36	.100
1916	60	2.80	.106
1917	56	2.08	.100

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Table 9.—*Number and percentage of fatalities due to explosives, at metal mines and quarries in the United States.*

Year.	Metal mines.		Quarries.	
	Number.	*Per cent.*	*Number.*	*Per cent.*
1911	78	11.22	50	26.60
1912	94	14.22	47	22.06
1913	89	13.03	44	24.04
1914	60	10.73	35	19.44
1915	78	14.10	28	18.92
1916	89	12.77	28	16.18

Table 10.—*Percentage of explosives used for various purposes in the United States during 1915, 1916, and 1917.*

	Coal mining.	Other mining.	Railway and other construction work.	All other purposes.	Total.
1917.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Black powder	85.1	3.4	4.7	6.8	100.0
High explosives	10.8	50.4	7.8	31.0	100.0
Permissibles	76.5	14.2	.2	9.1	100.0
Total	**51.0**	**25.4**	**5.7**	**17.9**	**100.0**
1916.					
Black powder	82.1	3.6	5.0	9.3	100.0
High explosives	8.2	51.6	8.6	31.6	100.0
Permissibles	76.6	17.9	.3	5.2	100.0
Total	**44.4**	**28.8**	**6.5**	**20.3**	**100.0**
1915.					
Black powder	84.8	3.4	3.6	8.2	100.0
High explosives	9.5	46.3	9.4	34.9	100.1
Permissibles	79.9	17.1	.5	2.5	100.0
Total	**45.9**	**26.1**	**6.4**	**21.5**	**99.9**

EXPORTS OF EXPLOSIVES, 1913–1917.

Table 11 shows the amount of explosives exported from the United States during the years 1913 to 1917, inclusive. In 1913 the total exports of gunpowder were 1,284,422 pounds; in 1917, 446,540,999 pounds. The tabulations of exports unfortunately do not segregate such explosives as picric acid, nitroglycerin, trinitrotoluene, and others. These are grouped in the column headed "all others." The total value of the exports was about $82,000,000 less in 1917 than in 1916, no doubt because of increased facilities for manufacturing explosives abroad.

TABLE 11.—*Explosives exported from the United States, 1913–1917.*[a]

	Cartridges.	Dynamite.		Gunpowder.		All other.	Total.
	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.	Dollars.	Dollars.
Total, 1913	3,015,399	13,399,616	1,498,222	1,284,422	359,855	651,601	5,525,077
Total, 1914	6,567,122	11,296,115	1,213,600	896,569	291,453	1,965,412	10,037,587
Total, 1915	25,408,079	11,446,368	1,509,050	84,358,379	66,922,807	95,129,957	188,969,893
1916. (Revised.)							
January	3,343,497	3,312,621	622,932	12,910,701	10,098,175	12,569,635	26,634,239
February	3,616,702	2,004,604	474,408	13,483,939	12,043,610	32,665,681	48,800,401
March	4,174,827	1,807,480	413,268	20,063,043	16,868,622	29,159,515	50,616,232
April	3,963,133	1,470,616	360,034	26,997,792	22,245,946	29,351,236	55,920,349
May	5,390,715	2,214,652	466,568	27,487,570	21,300,333	41,384,610	68,542,226
June	4,230,033	1,064,901	287,093	24,759,298	29,187,938	28,721,481	62,426,545
July	4,134,765	1,296,415	368,759	35,000,319	28,021,526	38,709,913	71,234,963
August	4,287,617	759,762	151,966	32,518,538	26,299,669	42,293,211	73,032,463
September	5,788,653	1,203,682	233,525	39,237,995	34,554,090	34,948,841	75,525,109
October	6,448,881	1,696,472	425,756	17,849,640	14,473,846	28,781,076	50,129,559
November	5,174,062	795,290	172,927	38,124,884	34,718,981	37,705,275	77,771,245
December	4,551,019	1,054,790	195,939	15,215,262	12,349,157	37,845,860	54,941,975
Total	55,103,904	18,681,285	4,173,175	303,648,981	262,161,893	394,136,334	715,575,306
1917.							
January	5,115,452	1,787,600	380,493	36,767,894	30,567,217	44,965,059	81,028,221
February	4,521,939	2,464,970	462,641	54,269,508	45,944,045	32,257,221	83,185,846
March	4,780,060	1,546,614	300,624	28,006,668	23 104,523	45,597,514	73,782,721
April	6,408,171	505,020	90,067	36,072,072	28,370,522	27,189,079	62,057,839
May	6,802,345	1,456,283	283,352	42,016,169	32,140,788	14,945,873	54,172,358
June	7,095,578	1,687,303	422,094	29,598,675	20,122,974	18,286,492	45,927,138
July	3,440,146	441,604	103,483	28,889,533	22,535,926	6,324,517	32,404,072
August	1,579,789	2,421,830	565,933	40,765,134	29,197,538	22,716,454	54,059,714
September	318,980	1,209,244	33,391	30,125,288	21,821,090	15,285,214	37,758,675
October	908,531	2,243,884	427,977	58,753,162	42,602,791	14,324,794	58,264,093
November	897,122	1,133,437	327,567	14,314,785	11,346,349	10,127,656	22,698,694
December	254,543	1,032,876	255,752	46,961,811	23,409,466	3,924,442	27,844,203
Total	42,122,656	17,930,665	3,653,374	446,540,999	331,163,229	255,944,315	633,183,574

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[a] Compiled from "Monthly Summary of Foreign Commerce of the United States," published by the Bureau of Foreign and Domestic Commerce, Department of Commerce.

PERMISSIBLE EXPLOSIVES TESTED PRIOR TO APRIL 30, 1918.

By S. P. Howell.

The following table contains the brand name, class designation on the basis of the volume of poisonous gases produced,[a] class designation on the basis of the characteristic ingredient,[b] grade of detonator or electric detonator prescribed, weight of 1¼ by 8 inch cartridge, smallest permissible diameter, unit deflective charge, rate of detonation, and the name of the manufacturer of each of the 160 permissible explosives that had been tested by the Bureau of Mines prior to April 30, 1918.

All of these explosives are subject to the conditions and provisions detailed in Technical Paper 169.[c]

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[a] Class A, 0 to 53 liters, inclusive; class B, more than 53 to 106 liters, inclusive· class C, more than 106 to 158 liters, inclusive.

[b] Class 1, ammonium nitrate; subclass *a*, containing a sensitizer that is in itself an explosive; subclass *b*, containing a sensitizer that is not in itself an explosive; class 2, hydrated; class 3, organic nitrate; class 4, nitroglycerin.

[c] Howell, S. P., Permissible explosives tested prior to Jan. 1, 1917: Tech. Paper 169, Bureau of Mines, 1917, 20 pp.

Permissible explosives tested prior to April 30, 1918.

Brand.	Class designation basis, volume of poisonous gases.	Class designation basis, characteristic ingredient.	When used with detonators, preferably electric detonators of not less efficiency than—	Weight of 1¼ by 8 inch cartridge.	Smallest permissible diameter.	Unit deflective charge.	Rate of detonation in 1¼ inch diameter cartridges.		Manufacturer.
1	2	3	4	5	6	7	8		9
				Grams.	*Inches.*	*Grams.*	*Feet per second.*	*Meters per second.*	
Aetna coal powder A	C	4	No. 6	184	1¼	277	12,620	3,848	Aetna Explosives Co. (Inc.), New York, N. Y.
Aetna coal powder AA	A	1a	do	a 214	1¼	241	7,880	2,403	Do.
Aetna coal powder B	C	4	do	179	1¼	301	9,870	3,008	Do.
Aetna coal powder C	B	do	do	198	1¼	344	7,010	2,138	Do.
Aetna coal powder No. 2	A	1a	do	186	1⅛	212	9,280	2,830	Do.
Bental coal powder No. 2	A	do	No. 7	180	1¼	276	4,750	1,447	Hercules Powder Co., Wilmington, Del.
Bental coal powder No. 2-X	A	do	No. 6	192	1¼	280	7,980	2,432	Do.
Big Red No. 1	B	do	do	171	⅞	240	7,250	2,209	The Equitable Powder Manufacturing Co. and the Egyptian Powder Co., East Alton, Ill.
Big Red No. 2	B	do	do	166	⅞	255	10,850	3,309	Do.
Big Red No. 4-L. F	B	do	do	171	⅞	254	10,290	3,138	Do.
Big Red No. 5	A	do	do	182	⅞	260	7,490	2,284	Do.
Big Red No. 6-L. F	B	do	do	174	⅞	242	7,480	2,280	Do.
Big Red No. 7	A	do	do	186	⅞	227	10,000	3,050	Do.
Bituminite No. 1	C	4	do	187	1¼	318	12,800	3,901	Aetna Explosives Co. (Inc.), New York, N. Y.
Bituminite No. 3	C	do	do	192	1¼	294	9,330	2,843	Do.
Bituminite No. 4	C	do	do	178	1¼	301	7,540	2,298	Do.
Bituminite No. 5	A	1a	do	176	1¼	231	9,120	2,782	Do.
Bituminite No. 8-L. F	C	4	do	155	1¼	303	9,300	2,834	Do.
Black Diamond No. 2-A	C	do	do	190	1¼	281	12,600	3,842	Illinois Powder Manuafcturing Co., St. Louis, Mo.
Black Diamond No. 3-A	C	do	do	156	1¼	294	11,160	3,402	Do.
Black Diamond No. 5	A	1a	do	180	1¼	288	6,020	1,835	Do.
Black Diamond No. 6-L. F	C	4	do	158	1¼	306	9,630	2,935	Do.
Black Diamond No. 7	A	1a	do	183	1¼	214	10,730	3,270	Do.
Black Diamond No. 8	B	4	do	168	1¼	295	8,730	2,663	Do.
Cameron mine powder No. 1-A	A	1a	do	156	1¼	227	10,950	3,339	Grasselli Powder Co., Cleveland, Ohio.
Cameron mine powder No. 2-A	A	do	do	a 224	1½	230	b 10,520	b 3,206	Do.
Cameron mine powder No. 2-A, L. F	A	do	do	215	1¼	233	10,950	3,338	Do.
Cameron mine powder No. 3-A	C	4	do	192	1¼	296	10,930	3,333	Do.
Cameron mine powder No. 5-A	C	do	do	226	1⅛	299	8,900	2,712	Do.
Carbonite No. 1	C	do	do	226	1¼	259	10,950	3,338	E.I. du Pont de Nemours & Co., Wilmington, Del.
Carbonite No. 2	C	do	do	170	1¼	302	11,380	3,470	Do.
Carbonite No. 2-L. F	C	do	do	180	⅞	305	7,830	2,387	Do.
Carbonite No. 3	C	do	do	174	1¼	325	8,710	2,656	Do.

Carbonite No. 4	C	do	do	200	1¼	327	7,670	2,339	Do.
Carbonite No. 5	C	do	do	175	⅞	304	10,140	3,092	Do.
Carbonite No. 6	C	do	do	175	⅞	345	7,490	2,285	Do.
Coalite X	A	1[a]	do	156	1¼	226	9,000	2,745	Atlas Powder Co., Wilmington, Del.
Coalite Y	B	do	do	164	⅞	235	10,300	3,141	Atlas Powder Co., Wilmington, Del., and the Giant Powder Co. (Con.), Giant, Cal.
Coalite No. 1	C	4	do	232	1¼	296	7,930	2,418	Do.
Coalite No. 2–D	B	do	do	233	1¼	310	8,430	2,571	Do.
Coalite No. 2–D. L	C	do	do	146	1⅛	271	7,340	2,237	Do.
Coalite No. 2–M. L. F	C	do	do	157	1¼	301	9,220	2,811	Do.
Coalite No. 3–XC	B	1[a]	do	164	1¼	250	8,320	2,536	Atlas Powder Co., Wilmington, Del.
Coalite No. 3–YC	B	do	do	162	⅞	250	9,670	2,940	Atlas Powder Co., Wilmington, Del., and the Giant Powder Co. (Con.), Giant, Cal.
Coal special No. 1	B	4	do	214	1¼	288	11,800	3,598	Aetna Explosives Co. (Inc.), New York N. Y.
Coal special No. 1–A	C	do	do	148	1¼	276	9,370	2,857	Do.
Coal special No. 1–L. F	C	do	do	150	1¼	277	8,280	2,524	Do.
Coal special No. 2	C	do	do	201	1¼	304	10,240	3,123	Do.
Coal special No. 2–W	C	do	do	180	1¼	277	11,590	3,534	Do.
Coal special No. 3–C	C	do	do	192	1¼	288	9,760	2,977	Do.
Collier powder B, N. F	B	1[a]	do	176	1¼	224	10,950	3,338	Do.
Collier powder KN	A	do	do	175	1⅛	222	11,610	3,539	Do.
Collier powder No. X	A	do	do	192	1¼	273	7,820	2,384	Do.
Collier powder No. Y	A	do	do	172	1¼	229	9,740	2,970	Do.
Collier powder X. I. F. 1	B	1[a]	do	164	1¼	237	8,140	2,483	Do.
Collier powder X, L. F	A	do	do	196	1¼	252	9,990	3,047	Do.
Collier powder No. 2	C	4	do	146	1¼	300	8,870	2,704	Do.
Collier powder No. 5	A	1[a]	do	178	1¼	240	8,280	2,524	Do.
Collier powder No. 5–L. F	A	do	do	186	1⅛	232	9,370	2,858	Do.
Collier powder No. 5, special	A	do	do	180	1⅛	236	8,330	2,541	Do.
Collier powder No. 6	A	do	do	169	1¼	214	11,220	3,422	Do.
Collier powder No. 6–L. F	C	4	do	174	1¼	317	9,660	2,944	Do.
Collier powder No. 9	B	1[a]	do	197	1¼	283	6,690	2,040	Do.
Collier powder No. 11	A	do	do	165	1¼	217	11,680	3,561	Do.
Collier powder No. 11–L. F	B	do	do	180	1¼	226	10,850	3,307	Do.
Cronite No. 1	A	do	do	149	1¼	233	10,490	3,198	G. R. McAbee Powder & Oil Co., Pittsburgh, Pa.
Cronite No. 5	B	do	No. 7	165	1¼	249	8,090	2,466	Do.
du Pont Lump-Coal Powder No. 1	A	4	No. 6	185	1¼	382	5,200	1,586	E. I. du Pont de Nemours & Co., Wilmington, Del.
du Pont Permissible No. 1	B	1[a]	do	175	⅞	278	9,610	2,930	Do.
Eureka No. 2	B	2	do	190	1¼	311	10,720	3,269	G. R. McAbee Powder & Oil Co., Pittsburgh, Pa.
Franklinite No. 1	C	4	do	192	1¼	288	9,760	2,977	Aetna Explosives Co. (Inc.), New York, N. Y.
Franklinite No. 2	C	do	do	146	1¼	300	8,870	2,704	Do.
Franklinite No. 3	C	do	do	201	1¼	304	10,240	3,123	Do.
Franklinite No. 4	B	do	do	198	1¼	344	7,010	2,138	Do.
Franklinite No. 5	A	1[a]	do	186	1⅛	232	9,370	2,858	Do.
Franklinite No. 6	A	do	do	196	1¼	252	9,990	3,047	Do.
Fuel-ite No. 3	B	do	do	179	1¼	215	8,590	2,620	Grasselli Powder Co., Cleveland, Ohio.
Fuel-ite No. 3–L. F	B	do	do	172	1¼	229	10,810	3,296	Do.
General Coal Powder B	C	4	do	187	1¼	299	10,640	3,244	General Explosives Co., Joplin, Mo.
Giant coal-mine powder No. 5	B	1[a]	do	157	1¼	228	10,230	3,118	Giant Powder Co. (Con.), Giant, Cal.
Guardian No. 2	A	do	do	202	1¼	245	8,980	2,738	Hercules Powder Co., Wilmington, Del.
Guardian No. 2–X	A	do	do	204	1¼	245	7,990	2,437	Do.
Guardian No. 3	B	do	do	186	1¼	272	7,660	2,336	Do.

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[a] 1¼-inch by 8-inch cartridge.

[b] 1¼-inch diameter cartridges.

Permissible explosives tested prior to April 30, 1918—Continued.

Brand.	Class designation basis, volume of poisonous gases.	Class designation basis, characteristic ingredient.	When used with detonators, preferably electric detonators of not less efficiency than—	Weight of 1¼ by 8 inch cartridge.	Smallest permissible diameter.	Unit deflective charge.	Rate of detonation in 1¼-inch diameter cartridges.		Manufacturer.
1	2	3	4	5	6	7	8		9
				Grams.	*Inches.*	*Grams.*	*Feet per second.*	*Meters per second.*	
Guardian No. 3-X	A	1*a*	No. 6	183	1¼	252	8,470	2,582	Hercules Powder Co., Wilmington, Del.
Hecla No. 2	A	do	No. 7	188	1¼	253	13,990	4,264	E. I. du Pont de Nemours & Co., Wilmington, Del.
Hygrade coal powder No. 2	B	4	No. 6	232	1¼	329	8,450	2,576	Hygrade Powder Co., Philadelphia, Pa.
Kanite A	A	1*b*	No. 8	[a] 319	1¾	255	[b] 10,730	[b] 3,270	W. H. Blumenstein Chemical Works, Pottsville, Pa.
King No. 2-A [c]	C	4	No. 6	190	1¼	281	12,600	3,842	The King Powder Co., Cincinnati, Ohio.
King No. 3-A [c]	C	do	do	156	1¼	294	11,160	3,402	Do.
King No. 5 [c]	A	1*a*	do	180	1¼	288	6,020	1,835	Do.
King No. 6-L. F [c]	C	4	do	158	1¼	306	9,630	2,935	Do.
King No. 7 [c]	A	1*a*	do	183	1¼	214	10,730	3,270	Do.
King No. 8 [c]	B	4	do	168	1¼	295	8,730	2,663	Do.
Little Red No. 2	B	do	do	185	⅞	321	9,300	2,836	The Equitable Powder Manufacturing Co. and the Egyptian Powder Co., East Alton, Ill.
Little Red No. 3	C	do	do	163	⅞	325	7,940	2,421	Do.
Little Red No. 4	B	do	do	193	⅞	349	8,100	2,469	Do.
Little Red No. 5-L. F	B	do	do	177	⅞	300	11,110	3,387	Do.
Little Red No. 6-L. F	B	do	do	168	⅞	333	7,650	2,331	Do.
Lomite No. 1	B	2	do	176	1¼	300	13,940	4,250	G. R. McAbee Powder & Oil Co., Pittsburgh, Pa.
Lowinite No. 2-B	A	1*a*	do	148	1¼	258	9,740	2,971	Lowinite Explosives Manufacturing Co., Pittsburgh, Pa.
Meteor AXXO	A	2	do	265	1¼	434	8,410	2,563	E. I. du Pont de Nemours & Co., Wilmington, Del.
Mine-ite A	B	4	do	183	1¼	296	11,290	3,443	Grasselli Powder Co., Cleveland, Ohio.
Mine-ite A-2	C	do	do	156	1¼	319	10,670	3,252	Do.
Mine-ite B	C	do	do	168	1¼	340	9,540	2,908	Do.
Mine-ite No. 5-D	A	1*a*	do	161	1¼	241	8,720	2,658	Do.
Mine-ite No. 6-D	B	do	do	169	1¼	224	8,090	2,467	Do.
Miners Friend No. 1	B	do	do	182	⅞	233	11,580	3,529	Atlas Powder Co., Wilmington, Del., and the Giant Powder Co. (Con.), Giant, Cal.
Miners Friend No. 2	B	do	do	182	⅞	260	10,330	3,149	Do.
Miners Friend No. 3	B	do	do	174	⅞	252	8,030	2,449	Do.
Miners Friend No. 4	B	do	do	179	⅞	261	9,980	3,044	Do.
Miners Friend No. 5	B	do	do	190	⅞	250	8,570	2,614	Do.
Miners Friend No. 6	B	do	do	167	⅞	234	10,900	3,324	Do.
Miners Friend No. 7	A	do	do	176	⅞	253	8,950	2,729	Do.
Miners Friend No. 8-L. F	A	4	do	193	1¼	421	4,650	1,417	Do.

Monobel No. 1	B	1[a]	do	179	1¼	216	11,700	3,568	**E. I. du Pont de Nemours & Co., Wilmington, Del.**
Monobel No. 2	B	do	do	178	⅞	239	9,870	3,009	Do.
Monobel No. 3	B	do	do	174	⅞	243	7,260	2,212	Do.
Monobel No. 4	B	do	do	174	⅞	248	8,980	2,738	Do.
Monobel No. 5	B	do	do	179	1	267	6,760	2,061	Do.
Monobel No. 6	B	do	do	175	⅞	218	10,380	3,165	Do.
Monobel No. 7	B	do	do	180	⅞	211	10,050	3,065	Do.
Nitro low-flame No. 1	C	4	do	234	1¼	303	13,380	4,079	**Nitro Powder Co., Kingston, N. Y.**
Nitro low-flame No. 2	C	do	do	226	1¼	298	14,560	4,439	Do.
Red H No. 1	B	1[a]	do	167	1¼	216	11,700	3,568	**Hercules Powder Co., Wilmington, Del.**
Red H No. 2	B	do	do	160	⅞	239	9,870	3,009	Do.
Red H No. 3	B	do	do	173	⅞	243	7,260	2,212	Do.
Red H No. 4	B	do	do	164	⅞	248	8,980	2,738	Do.
Red H No. 5	B	do	do	170	1	267	6,760	2,061	Do.
Red H No. 6	B	do	do	162	⅞	218	10,380	3,165	Do.
Red H No. 7	B	do	do	180	⅞	211	10,050	3,065	Do.
Red H No. 8	B	do	do	164	⅞	278	7,590	2,315	Do.
Trojan coal powder H	A	3	do	218	1¼	394	9,420	2,872	**Pennsylvania Trojan Powder Co., Allentown, Pa.**
Trojan coal powder I	A	do	do	218	1¼	410	9,620	2,934	Do.
Trojan coal powder J	A	do	do	229	1¼	360	10,590	3,230	Do.
Trojan coal powder K	B	do	do	181	1⅛	314	10,380	3,164	Do.
Trojan coal powder L	B	do	do	166	1⅛	275	10,560	3,221	Do.
Trojan granular coal powder No. 1	A	do	do	[d] 247	1⅞	265	[e] 7,920	[e] 2,416	Do.
Tunnelite AA	A	1[a]	do	176	1⅛	253	7,690	2,346	G. R. McAbee Powder & Oil Co., Pittsburgh, Pa.
Tunnelite B	B	do	do	167	1⅛	249	9,990	3,047	Do.
Tunnelite C	A	do	do	187	1⅛	255	10,060	3,068	Do.
Tunnelite No. 3	C	4	do	150	1⅛	291	10,110	3,083	Do.
Tunnelite No. 4	C	do	do	136	1⅛	309	10,620	3,238	Do.
Tunnelite No. 5	C	do	do	176	1¼	328	8,400	2,562	Do.
Tunnelite No. 6	C	do	do	172	1¼	305	9,670	2,947	Do.
Tunnelite No. 6–L. F	C	do	do	156	1¼	301	9,620	2,933	Do.
Tunnelite No. 7	C	do	do	164	1¼	311	8,720	2,659	Do.
Tunnelite No. 8	C	do	do	158	1¼	324	8,020	2,446	Do.
Tunnelite No. 8–L. F	C	do	do	176	1¼	322	8,720	2,658	Do.
Vigorite No. 1	C	do	do	204	1¼	259	10,950	3,338	Atlas Powder Co., Wilmington, Del., and the Giant Powder Co. (Con.), Giant, Cal.
Vigorite No. 2	C	do	do	168	⅞	298	10,920	3,330	Do.
Vigorite No. 3	B	do	do	160	⅞	320	8,140	2,483	Do.
Vigorite No. 4	B	do	do	186	⅞	341	7,480	2,281	Do.
Vigorite No. 5	C	do	do	156	⅞	308	10,830	3,303	Do.
Vigorite No. 6	C	do	do	166	⅞	345	7,490	2,285	Do.
Xpdite No. 1	C	do	do	211	1¼	259	10,950	3,338	Hercules Powder Co., Wilmington, Del.
Xpdite No. 2	C	do	do	168	1¼	302	11,380	3,470	Do.
Xpdite No. 3	C	do	do	162	1¼	325	8,710	2,656	Do.
Xpdite No. 4	C	do	do	190	1¼	327	7,670	2,339	Do.
Xpdite No. 5	C	do	do	166	⅞	304	10,140	3,092	Do.
Xpdite No. 6	C	do	do	165	⅞	345	7,490	2,285	Do.

[a] 1¾ by 8 inch cartridge.

[b] 1¾-inch diameter cartridges.

[c] Same as the corresponding brands of the Black Diamonds, p. 16.

[d] 1⅞ by 8 inch cartridge.

[e] 1⅞-inch diameter cartridges.

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